

ANIMAL TRYPANOSOMIASIS IN THE LADO (WESTERN MONGALLA) AND NOTES ON TSETSE FLY TRAPS AND ON AN ALLEGED IMMUNE BREED OF CATTLE IN SOUTHERN KORDOFAN

BY

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PLATES IX, X

When, some years ago, the Sudan Government took over the region known as the Lado Enclave, which now stretches from the sixth parallel of North Latitude southward to Lake Albert and extends from the Bahr-el-Jebel on the east some 120 miles inland to the frontier of the Belgian Congo, it found itself in possession of an area infected with sleeping sickness. Since that time a great deal has been done by Captain Thompson and Lieut. Ranken, R.A.M.C., in studying this disease and to combat it both prophylactically and therapeutically, but, so far, little attention has been paid to the forms of animal trypanosomiasis present in this part of Africa. The following short and, of necessity, incomplete paper is intended as a preliminary contribution to the subject, and also contains notes on certain other matters intimately associated either with human or animal trypanosomiasis.

I. In May of last year I visited the sleeping sickness camp at Yei, in what is now known as Western Mongalla, the name Lado having been abandoned, as the old Belgian station of Lado on the Nile has disappeared. On the way thither, and when at Yei, I had a few opportunities of examining the blood of transport and other domestic animals. At Loka, a post intermediate between Rejaf and Yei, I found mules infected with trypanosomiasis, and at Yei found a donkey which had been infected when in the fly region of the Moru district further to the north and west.

Lately Captain R. J. C. Thompson, R.A.M.C., who has done such good work in charge of the sleeping sickness camp and in connection with clearance operations, sent me the blood of three of the transport bulls working on the old Belgian automobile road which runs from Rejaf on the Nile, through Loka and Yei, to Aba on the Congo frontier.

He had found these animals infected, and was anxious to know the type of trypanosome present. We will, therefore, first consider the infection in the case of these bulls. A mere glance at the films showed that we were dealing with a trypanosome of the *pecorum-nanum-congolense* group. The films had been fixed in absolute alcohol, and, though rather old, stained sufficiently well with Giemsa to permit of their being accurately drawn at a magnification of 2,000 diameters by the aid of Greil's projection apparatus. This, combined with Bruce's method of measuring, is probably the most accurate means of determining the dimensions of stained trypanosomes. The best results are, however, obtained by fixation with osmic acid. From the three slides 140 parasites were drawn and measured. Attached is the curve (Chart I) obtained on plotting the measurements according to Bruce. It will be found to answer very closely to that for the Sudan *T. nanum*, shown in Vol. A of the Fourth Report of these Laboratories (1911, p. 55). The trypanosome is small, short, and shows no free flagellum. The following statement gives the figures in respect to length:—

	Minimum	Maximum	Average
Length in microns ...	9·8	17	12·6

These dimensions are quite near enough those given by Bruce, Laveran and Mesnil and other observers for *T. nanum* to permit of its being considered as this trypanosome, so far as length goes. The breadth at the broadest part varied from 1μ to 2μ , which is also in keeping with that of *T. nanum*. The accompanying microphotographs show sufficiently well the general aspect of the parasite. Pl. IX, fig. 1 shows a typical short *T. nanum*-like form; fig. 2 a longer variety with a better marked undulating membrane. Neither shows any free flagellum. The infection was, in none of the three cases, very heavy, but I am informed it is proving fatal to the transport bulls. Captain Thompson also informed me that he thinks it may be associated with trypanosomiasis in a herd of cattle

at Mongalla on the east bank of the Nile. I wired to the Governor as to the locality from which this herd came, but failed to elicit any definite information. Archibald,¹ however, has described *T. pecorum* as occurring in a cow from Bor, which is in the more

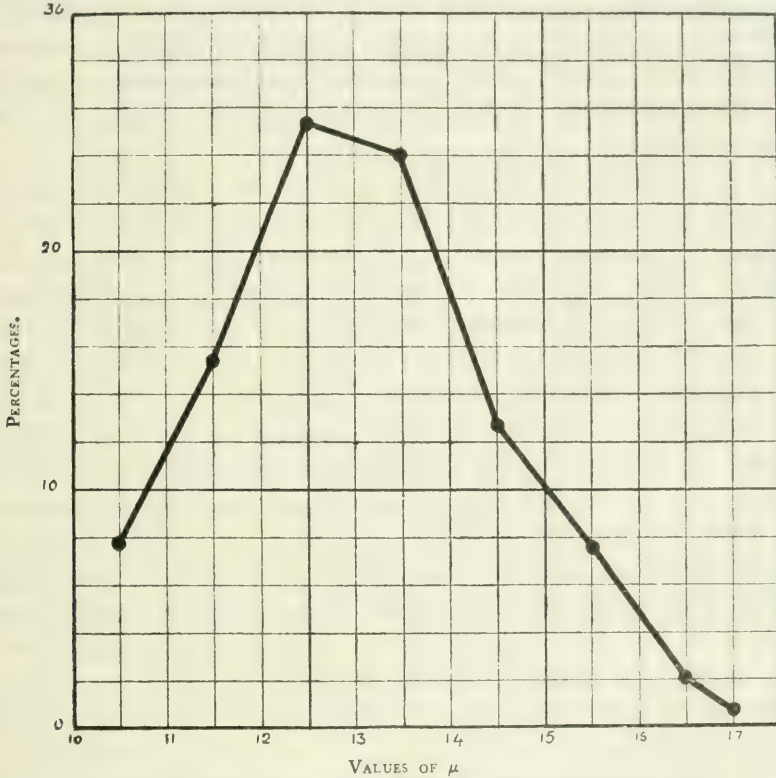


CHART I. Curve of measurements of trypanosome from transport bull.

northerly part of the Mongalla Province and on the east bank of the river. Until animal inoculations were carried out, it was of course impossible to decide accurately the species of trypanosome with which we were dealing. Accordingly, I wired to Captain Thompson, asking him if at all possible to inoculate laboratory and other animals, and to let me know the result. I have now heard from him to the effect that an inoculated dog showed trypanosomes in its blood fourteen days after the injection.* It would, therefore,

* These trypanosomes then disappeared and were not again found, while the dog has remained throughout in good condition. Fifteen rats which were inoculated died within 48 hours of inoculation from some unknown cause. It would seem, therefore, that the bull trypanosome may have been *T. nanum* after all.

seem that we are dealing with *T. pecorum*, not *T. nanum*. Certainly fig. 2 shows a trypanosome more of the *pecorum* than the *nanum* type, and also (if we accept the views of Laveran and Mesnil² as to *T. congolense* being a distinct species) than the *congolense* type. As a matter of fact, so far as the measurements go, they are nearer those given for *T. pecorum* than for *T. nanum*. In any case the positive result of animal inoculation puts the matter beyond doubt so far as these two species are concerned. (But see footnote on p. 115.)

If the infection has been derived along the automobile road in Western Mongalla (late Lado Enclave) the vector is in all probability *Glossina palpalis*, as *G. morsitans* is not found in this locality, and the only other biting flies in evidence are *Haematopota*. It is, however, very probable that these bulls were infected before going to Western Mongalla, and that some species of *Tabanus*, *Chrysops*, or *Stomoxys* is the active agent in transmitting this form of animal trypanosomiasis in the Southern Sudan. I have mentioned the donkey from the Moru country. I kept only one film of this animal's blood, and, as the infection is very small, have not troubled to draw and measure the parasites. The trypanosome, however, is undoubtedly of the same type as that found in the bulls (fig. 3). Again, if we accept Laveran's view, I think it will be admitted that it is very like *T. congolense*. Considering the history of this trypanosome, it is exceedingly likely that it is *T. congolense*, but there is, of course, no definite proof so far.

As regards the infected mules at Loka, I took films and fixed them in absolute alcohol, having no osmic acid with me. Later these films were stained with Giemsa. The infection was somewhat sparse, and at a magnification of 2,000 diameters it took a long time to draw even as many as a hundred from different slides. This, however, was done, and they were measured by Bruce's method, the curve being given in Chart II.

The measurements in respect to length are as follows:—

	Minimum	Maximum	Average
Length in microns ...	10.5	28	17.6

Figs. 4 and 5 show the general aspect of the parasites. It will be seen that this trypanosome is of the *brucei* or *gambiense* type

in that there is a long and comparatively slender form with a free flagellum, and a short, stout form with hardly any free flagellum. (Pl. IX, fig. 5, shows a form with the blepharoplast just beginning to divide.) The breadth of the former varies from 1.2μ to 2μ , of the latter from 1.7μ to as much as 5μ , there being a few very stout and swollen-looking forms. These did not seem in any way degenerate, but the appearance they presented was possibly artificial and due to slow fixation permitting of contraction and broadening. The usual breadth of these forms was from 2.5μ to 3μ .

A marked feature of this trypanosome was the frequent occurrence of an unstained area, usually of a spherical shape, in the neighbourhood of the blepharoplast. This is, of course, sometimes

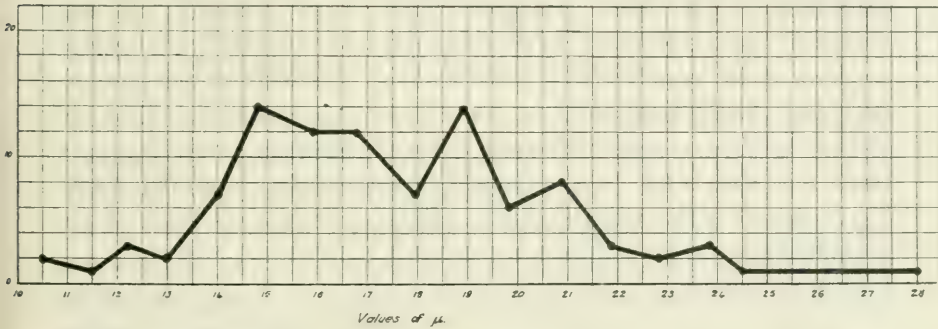


CHART II. Curve of measurements of mule trypanosome.

seen in *T. gambiense* and other species, but I have never known it so frequent or well defined as in this trypanosome. It was specially evident in the short, stout forms, but was occasionally seen in the forms showing a long free flagellum (figs. 4 and 5). Possibly it is merely the product of a faulty fixation. It will be noticed from the curve that a few dwarf or stumpy forms were present. Whether these indicate that there is a double infection, or whether they are like the so-called 'tadpole' forms which have been described in *T. dimorphon* infections, I am unable to say. One of the sick mules accompanied me on my return journey from Loka to Rejaf. At the latter place I had a couple of gerbils on board our floating laboratory. These animals (*G. pygargus*) are as a rule very susceptible to trypanosome inoculation,* but though

* Infection invariably results after inoculation with *T. gambiense*, *T. evansi*, *T. brucei* (*pecauds*), and *T. pecorum*.

I gave each of them a large dose of citrated blood from the sick mule neither developed any infection.

Under these circumstances, I am unable to express any opinion as to the species which this trypanosome represents. The curve, Chart II, is certainly rather peculiar, there being two apices. It may be that a sufficient number of trypanosomes has not been measured, or, again, it is possible that had the fixation been better the staining of the free flagella might have been better also, and the two apices might then have been compounded into a single apex at or about 19μ . Even in this case, however, it would not have answered very closely to that given by Bruce for the Uganda strain of *T. brucei*. I suggest that it may be the same pleomorphic trypanosome (*Trypanosoma*, sp. ?) found by Kinghorn and Yorke³ in a bushbuck. The mule transport had been working in the southern Bahr-el-Ghazal before coming to Western Mongalla, so that it is possible the infection was derived in the former province, where but little is yet known regarding the different strains of trypanosome affecting domestic animals. In the past there has been free communication between what was the Lado Enclave and both Uganda and the Belgian Congo, so that, in all probability, various trypanosome infections of bovines and equines have been introduced into Western Mongalla. It is very desirable, as has been shown by the work of Kinghorn and Yorke in many reports, notably those cited,³⁻⁴ as also by Duke⁵ and by numerous French observers in West Africa, to determine accurately the different species of trypanosome affecting domestic stock and their insect vectors. These short and incomplete notes may be of some help to those whose duty it will be to work out the problems on the spot, for there is now a good laboratory at Yei, and Lieutenant Ranken intends to extend his researches, both to the disease in domestic animals and to the question of the presence of trypanosomes in big game. The region is so remote and difficult of access that it is well-nigh impossible to carry out the work satisfactorily in Khartoum.

II. In the British Medical Journal for July 6th, 1912, I⁶ drew attention to the subject of tsetse fly traps. I have now had large traps constructed by the Andrés Maire Company. These (Pl. X, fig. 6) are not exactly what I intended. Indeed, they differ very

little from the cotton moth trap invented by this firm, but both Mr. King and I think they may serve the purpose of trapping tsetse, provided it is found the flies will enter them.

As regards methods of attraction, the following measures will be tried:—

1. Soaking the central bands or wicks in a mixture of water and either human or animal sweat.
2. Placing a live animal in the trap—a suggestion made by Captain O'Farrell.
3. Soaking the central bands in citrated blood, and at the same time hanging up in the trap a piece of fresh meat from ox or buck with skin still adherent.
4. Soaking the bands as above and having in addition a tube of citrated blood arranged according to the ingenious device of Rodhain and his colleagues.⁷ If desired, the blood in this tube may be poisoned.

It is hoped that one or other of these measures may be effective. Lieutenant Ranken will shortly take two of these traps with him to Yei, and carry out the necessary experiments.

III. Fig. 7 is a photograph of a full-grown bull of the small black breed found in Southern Kordofan. It was kindly sent me, at my request, by Major R. S. Wilson, Governor of the Nuba Mountains Province.

This breed is said to be immune to trypanosomiasis, and is the only breed which can live in the infected Koalib area, where *G. morsitans* abounds and conveys an infection due to what I believe is *T. brucei*. It is interesting to note that an apparently similar breed exists in Northern Nigeria. Pollard⁸ reports that

There is in the Munshi Division, and in the northern part of the province, a small black breed of cattle which is apparently immune to tsetse. At any rate, these cattle can be kept in the Munshi district, where no horses can live and where imported Fuhlani cattle all die. I have not yet obtained any blood-films from these animals.'

The Kordofan breed may, of course, only be immune to one species of trypanosome, and, where only one specimen of these cattle is available, it does not seem desirable to make experiments in this

direction. On the other hand, it will be interesting to note the effect of the blood serum of this bull on various trypanosome strains. Some work along this line has been commenced, and will be continued as circumstances permit. At present it is too early to make any statement regarding it.

I am indebted to Mr. G. Hunt, of the Engineering School of the Gordon College, for kindly plotting the curves for me. The photographs are the work of Mr. George Buchanan.

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EXPLANATION OF PLATES

Trypanosomes magnified 2,000 diameters approximately.

PLATE IX

- Fig. 1. *Trypanosoma pecorum*? From bull. Note short, stout forms.
- Fig. 2. *T. pecorum*? Long form. From bull.
- Fig. 3. *T. congolense*? From donkey.
- Fig. 4. *Trypanosoma*, sp. ? From mule.
- Fig. 5. *Trypanosoma*, sp. ? From mule.

PLATE X

Fig. 6. Tsetse fly trap.

Fig. 7. Pigmy bull of black breed from Southern Kordofan, said to be immune to 'fly.'



FIG. 1

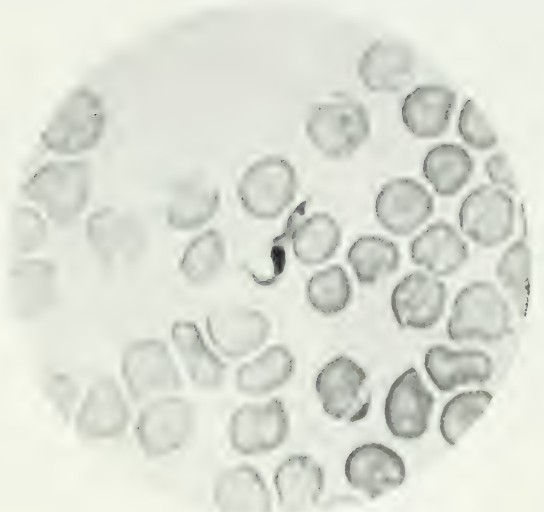


FIG. 2

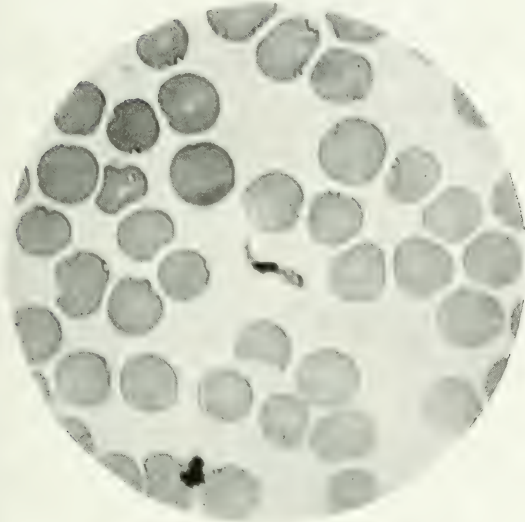


FIG. 3



FIG. 4

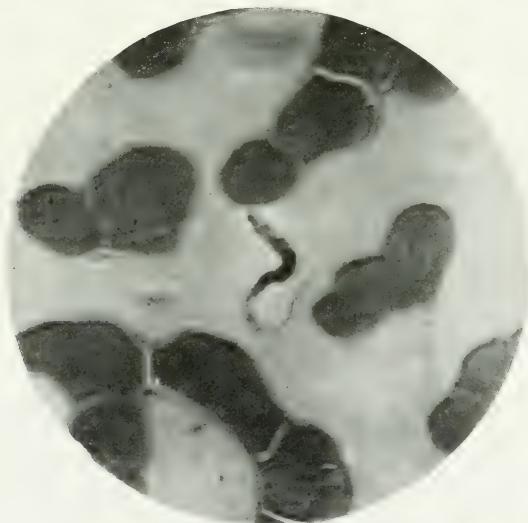


FIG. 5

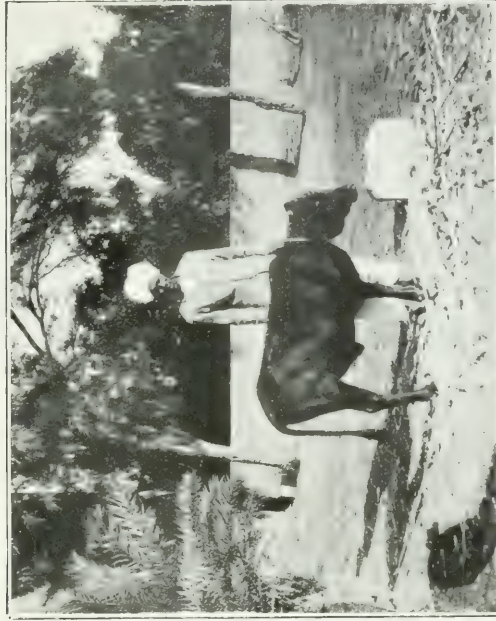


FIG. 7

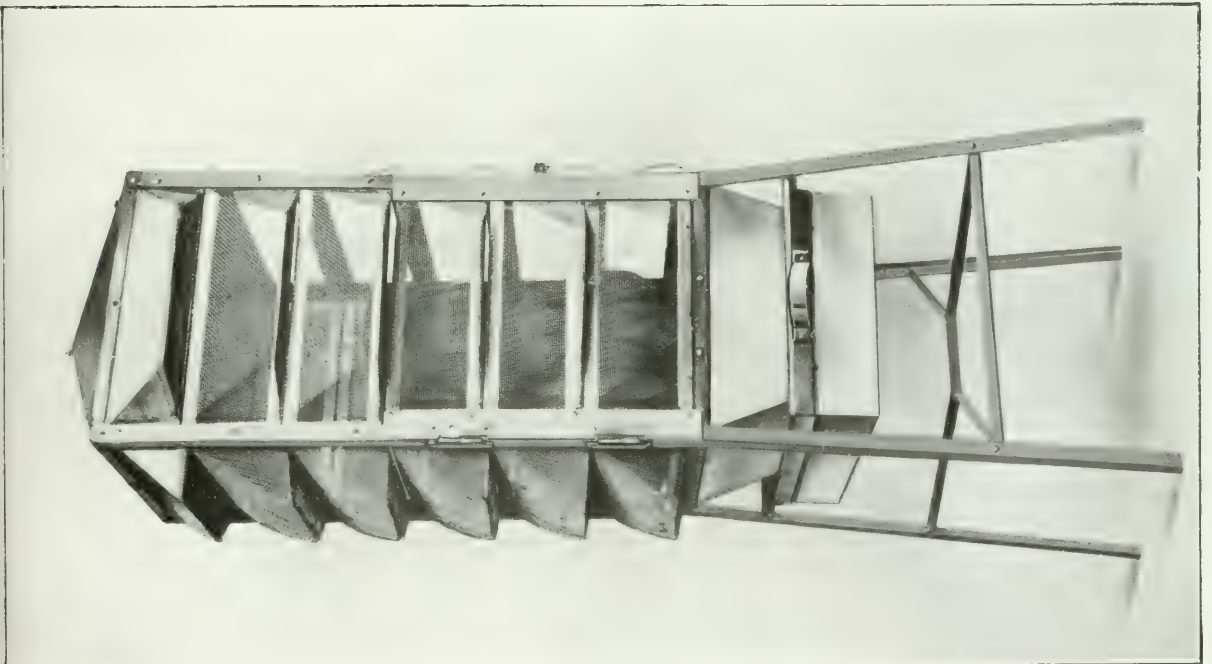


FIG. 6